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Study supported by The Aetna Foundation, a national foundation based in Hartford Connecticut that supports projects to promote wellness, health and access to high quality health care for everyone. The views presented here are those of the author and not necessarily those of The Aetna Foundation, its directors, officers, or staff.

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The comparative impact of different patient-centered medical home domains on satisfaction among individuals living with type II diabetes

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Abstract

Chronic illnesses like type 2 diabetes are costly and difficult to treat. Patient-centered medical homes (PCMH) have the potential to improve patient satisfaction in this population. However, which domains have the most impact on patient satisfaction has not been established. The aim of this study was to assess the relative strength of association between seven PCMH domains and two measures of satisfaction. Cross-sectional data were used in this observational study collected from a random sample of adults aged 18-89 with type 2 diabetes (n=1301) seen at 4 PCMHs. The Ambulatory Care Experiences Survey instrument was used to assess all measures. Dependent variables included 2 measures of patient satisfaction: overall care and personal doctor. Independent variables included patient perceptions of implementation level of 7 PCMH domains categorized into two dimensions: administrative features of care and physician-patient interactions. Administrative features of care include organizational access, integration of care and office staff helpfulness. Physician-patient interactions include communication, comprehensive knowledge and interpersonal treatment. Analysis was conducted using linear regression. The results reveal all physician-patient interaction PCMH domains were significantly associated with both measures of satisfaction. The relationships for administrative features of care were dependent upon the satisfaction outcome being analyzed. Communication and comprehensive knowledge had the strongest association of all domains. The authors conclude variations in importance of PCMH domains on satisfaction exist. Physician-patient interaction domains are the strongest contributors to patient satisfaction and overall experience. Understanding which PCMH domains have the largest impact can inform physician practice's efforts to improve outcomes of care.

Keywords

Patient experience, patient satisfaction, patient-centered care, patient- and family- centered care, diabetes

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Introduction

The United States has long been criticized for its fragmented approach to delivering care to patients with chronic illnesses¹. In response, there are calls for more effective care management strategies to improve outcomes for those with chronic illness, including diabetes.²⁻⁴ One promising approach is the patient-centered medical home (PCMH). Although definitions of a PCMH vary, there is general agreement on the main principles that include the following: access to comprehensive services, continuity of

care, coordination and integration, quality and safety, and whole-person orientation. The goals of this approach are improved access, reduced costs and improved health outcomes.⁵⁻⁸ Chronic conditions such as diabetes are difficult to treat, require well-coordinated care over the long-term and therefore are well suited to the methods of a PCMH.⁹ PCMHs have had positive effects on quality, clinical outcomes and costs for those with diabetes^{9,10} but knowledge regarding the impact of the PCMH approach on patient satisfaction among individuals living with type 2 diabetes is relatively limited.

Patient preferences, experiences, and satisfaction with care are recognized as key aspects of health care quality. Indeed, the term patient-centered implies that patient preferences must be taken into account in health care's design and delivery. Examples of the recent emphasis placed on patient preferences in health care delivery include linking provider reimbursement to measures of patient satisfaction and the inclusion of patient satisfaction metrics on quality report cards. Patient experiences with care have also been found to be associated with other outcomes. For example, a systematic review that summarized results from 55 studies showed positive associations between patient experience, patient safety and clinical effectiveness, including adherence to medication and health promoting behaviors, such as the use of screening services and immunizations.¹¹

There is some emerging evidence of the effectiveness of PCMHs on patient satisfaction and experiences with care.^{7,12-15} A meta-analysis concluded that moderate-strength evidence exists suggesting a small positive relationship between PCMH defined interventions and patient satisfaction or patient experiences related to care coordination.¹² However, this recent research on PCMHs focuses on 'whole-system redesign' and not on the contributions of individual PCMH domains.¹⁶ Transforming a practice into a medical home requires a significant investment of time as well as financial and human resources.^{17,18} An understanding of the contributions of the individual domains to patient satisfaction will enable practices to focus on those aspects that will most likely improve outcomes of care. In this paper among people with type 2 diabetes, we examined the association of patient perceptions of seven PCMH domains with two measures of satisfaction: overall care and personal doctor. Further, we sought to identify whether the strength of association varied by domain and satisfaction measure.

We based our hypotheses on the Ambulatory Care Experiences Survey (ACES) framework that categorizes PCMH domains into one of two dimensions: administrative features of care and physician-patient interactions.¹⁹ Administrative features of care assess the administrative context in which patients receive care. PCMH domains belonging to this dimension from our study include organizational access, integration of care and office staff helpfulness. Given the administrative context of these domains, we hypothesized that administrative features of care will be more strongly associated with satisfaction with overall care compared to direct physician-patient interaction domains. The second ACES dimension is physician-patient interactions. Physician-patient interactions consist of four PCMH domains: communication, interpersonal treatment, trust and comprehensive knowledge. We viewed these domains as characterizations of the patient's relationship with their

physician and as such should be strongly associated with satisfaction with a personal doctor. Accordingly we hypothesized that scores for PCMH domains associated with physician-patient interaction will be more strongly associated with patient satisfaction with their personal doctor relative to domains from administrative features of care.

Methods

Design

In this observational study we used cross-sectional data obtained from a telephone survey of patients receiving care from four primary care family practices operated by the University of Florida, College of Medicine to serve as study sites. This study was approved by the University of Florida Institutional Review Board. Practices began implementing medical home components five years prior to the initiation of the study. Implementation was guided by National Committee for Quality Assurance (NCQA) Physician Practice Connections-Patient Centered Medical Home (PPC-PCMH) Recognition Program.²⁰ This program confers three nationally recognized levels of accreditation to physician practices. The level of accreditation signifies the number of the nine elements of care (e.g. access and communication, care management) identified as standards for being a PCMH that a practice has incorporated into their operations. In this study all practices have received Level 3 PCMH accreditation, which is the highest level possible. Level 3 indicates the practice has incorporated all nine elements of care.²⁰ All four practices use electronic medical records, supportive clinical services (e.g. dietitians and diabetes educators), a disease management program and a referral tracking process. Furthermore, all practices frequently refer patients to community support programs.²¹

Patients were eligible to participate in this study if they were 18 years and older, diagnosed with type 2 diabetes based on the International Classification of Disease – 9 codes (250-250.9),²² and had at least two office visits within the past two years at one of the participating clinics. Patients had previously chosen a clinic where they received care and therefore were not assigned to a practice for the purpose of this study. Across all four clinics, 5,300 patients were identified as meeting these eligibility requirements. Eligible patients were mailed a letter informing them of the survey and providing them with an opportunity to opt-out of participating. Two hundred and seventy people choose to opt-out of the study. The Survey Research Laboratory at the University of Florida then randomly selected individuals within each clinic who did not opt-out until we obtained a sample of 1,301 individuals. The cooperation rate for each clinic (the number of complete interviews divided by the number of telephone numbers contacted) ranged from 65 to 73 percent.

Measures

Dependent variables included two measures of patient satisfaction; satisfaction with overall care and satisfaction with primary care provider. Each measure was assessed using questions from the ACES survey (Table 1).²³ These questions have been incorporated from the Consumer Assessment of Healthcare Providers and Systems survey (CAHPS). Both the ACES and CAHPS survey instruments

have been previously validated for assessing patient satisfaction in primary health care settings.^{23,24}

Respondents were asked to rate their overall all care and personal doctor on a scale from 0 to 10, with 0 being the worst rating and 10 being the best. To meet linearity assumptions in regression models we used the natural log of these scores to perform the analysis.

Table 1: Survey questions from the Ambulatory Care Experiences Survey used for dependent and primary independent variables¹⁹

Satisfaction	Dependent Variables
Overall Care	Using any number from 0 to 10, where 0 is the worst care possible and 10 is the best care possible, what number would you use to rate your overall care?
Personal Doctor	Using any number from 0 to 10, where 0 is the worst possible personal doctor and 10 is the best possible personal doctor, what number would you use to rate your personal doctor?
Patient-Centered Medical Home Domain	Independent Variables
Organizational Access	When you needed care for an illness or injury how often did your personal doctor's office provide care as soon as you needed it?*
	When you scheduled an appointment for a check-up or routine care how often did you get the appointment as soon as you needed it?*
	When you called your personal doctor's office with a medical question during regular office hours how often did you get an answer the same day?*
	When you called your personal doctor's office after regular office hours, how often did you get the help or advice you needed?*
Integration of Care	When your personal doctor sent you for a blood test, x-ray, or other tests, did someone from your doctor's office follow-up to give you the test results?***
	How often did your personal doctor seem informed and up to date about the care you received from your specialist doctor?*
Comprehensive knowledge	How would you rate your doctor's knowledge of your medical history?***
	In the last 12 months, how often did your doctor seem to know all the important information about your medical history?*
Office Staff	In the last 12 months, how often were the office staff at your personal doctor's office HELPFUL as you thought they should be?*
Communication	How often did your personal doctor listen carefully to you?*
	How often did your personal doctor give you clear instructions about what to do to take care of the health problems and symptoms that were bothering you?*
	How often did your personal doctor explain things in a way that was easy to understand?*
Interpersonal Treatment	How often did your personal doctor spend enough time with you?*
Trust	How often did you feel you could tell your personal doctor anything, even things you might not tell anyone else?*

* 1 Never, 2 Almost Never, 3 Sometimes, 4 Usually, 5 Most Always, 6 Always
 ** 1 Yes Always, 2 Yes Sometimes, 3 No Never, 4 Not Applicable
 *** 1 Very Poor, 2 Poor, 3 Fair, 4 Good, 5 Very Good, 6 Excellent

Primary independent variables included patient perceptions of seven PCMH domains. Three are considered to be administrative features of care PCMH domains: organizational access, integration of care and office staff helpfulness. Four are considered to be physician-patient relationship PCMH domains: communication, trust, interpersonal treatment and comprehensive knowledge of the patient. All perceptions were assessed as a patient's score of how well the domain was implemented in the practice using questions from the ACES survey (Table 1).¹⁹ The ACES survey has been used in previous literature to measure patient scores of PCMH domains.¹⁷ Organizational access, communication, integration of care, and comprehensive knowledge are composite measures. Composite measures are single scores that are calculated by combining results from several related questions. Composite measures were calculated as the mean of the non-missing responses from each member question. If a participant did not provide a response to at least one question comprising the composite, the observation was scored as missing. Interpersonal treatment and trust are single item measures. All questions except integration of care are measured on a scale ranging from 1 to 6, with 1 indicating the lowest level of perceived implementation and 6 the highest level. Integration of care was measured using a scale ranging from 1 to 4 (Table 1). To prevent downward bias of scores stemming from integration of care, we converted the question into a six item ordinal scale by recoding responses to match the order and range of the other independent variables. For analysis, scores were dichotomized based on a threshold of a mean score of 4.5. Measures with a score (mean score for composites) greater than or equal to this threshold were coded as 1 indicating a high assessment of perceived implementation otherwise a value of 0 was given to indicate a low level. This cut point was established using distributional and sensitivity analyses.

Covariates with confounding potential were identified based on the Anderson Behavior Model (BM).²⁵ While the original BM analyzed predictors of health service utilization, the third version added consumer satisfaction as an outcome.²⁶ Given this is the dependent variable in this study it is appropriate to use the BM to identify potential confounders. Confounders were chosen from the three BM categories of predictors. The first category is predisposing characteristics, which include factors affecting the probability of needing services. Predisposing variables included in this study are age, race (White Non-Hispanic, Black Non-Hispanic, other), gender, and education level (some college or more, high school, less than high school). The second category is enabling characteristics which are factors affecting the ability to seek health care. Enabling factors included in this study are type of insurance (Medicaid/uninsured, Medicare, private, unknown), marital status (married, single,

divorced, widowed, unknown) and clinic (A, B, C, D). The third category is need characteristics, which are perceived, or evaluated "biological imperatives" that motivate a person to seek care. This study measured evaluated need through patient reported health status (excellent, good, fair, poor).

Analysis

Data preparation was performed using Statistical Analysis Software (SAS), Version 9.3.²⁷ Data analysis was performed using STATA SE, Version 13.1.²⁸ We used frequency and means procedures to describe the characteristics of the participants. To analyze the effect of the seven PCMH domains on the two measures of patient satisfaction, we ran two multivariate linear regression models. The first model (Model 1) estimated the impact of the PCMH domains on patient satisfaction with overall care. The second model (Model 2) estimated the impact of PCMH domains on satisfaction with a personal doctor. Both models controlled for the covariates identified as potential confounders. Since the patient satisfaction measures were transformed into natural logs for analysis, raw beta coefficients were converted to represent the average percent difference in the level of satisfaction between individuals that gave a high score for the PCMH domain and those that scored it low. This conversion was completed by subtracting one from the exponentiated raw beta coefficient.

Results

Sample Characteristics

Study sample characteristics are presented in Table 2. The average age was 60.9 ± 11.61 with a range of 19 to 89 years. The majority of participants consider themselves to be a minority, with only 37.43% identifying as White Non-Hispanic. A majority of participants reported having a high school education or higher (73.17%) and having a good or excellent health status (54.42%). A plurality of participants reported being married (40.20%) and being insured through Medicaid/uninsured (42.89%). Finally, clinic (D) represented a disproportionately low portion (13.30%) of the sample compared to the three urban clinics (A, B and C).

Model 1 – PCMH Domains and Satisfaction with Overall Care

Results for Model 1 are reported in Table 3. All seven PCMH domains had statistically significant associations with satisfaction with overall care ($p < .05$) with the exception of organizational access. Of the three PCMH domains considered to represent administrative features of care, office staff had the strongest association. Specifically, individuals that provided a high score for office staff helpfulness were on average 17.31% more satisfied with overall care compared to those that provided a low score for this domain ($p < .001$). All four physician-patient

Table 2: Sample Characteristics (n=1301)

	Frequency	%
Age years: Mean (SD)	60.9 (11.61)	
Gender (Male)	462	35.51
Education (17 Missing)		
Some College or More	464	35.66
High school	488	37.51
Less than high school	332	25.52
Health Status		
Excellent	247	18.99
Good	461	35.43
Fair	450	34.59
Poor	138	10.61
Race		
White Non-Hispanic	487	37.43
Black Non-Hispanic	639	49.12
Other	175	13.45
Marital Status		
Married	523	40.2
Single	304	23.37
Divorced	228	17.52
Widowed	223	17.14
Unknown	19	1.46
Insurance Type		
Private	336	25.83
Medicaid/Uninsured	558	42.89
Medicare	352	27.06
Unknown	55	4.23
Clinic		
Clinic A	362	27.82
Clinic B	361	27.75
Clinic C	405	31.13
Clinic D	173	13.3

interaction PCMH domains were statistically significant ($p < .05$). Within this group of PCMH domains communication had the strongest association with satisfaction with overall care ($p < .001$). Specifically individuals that perceived a high level of communication with their doctor on average were 33.28% more satisfied with their overall care compared to patients indicating low levels of communication. Also, the estimate for

communication was statistically larger than the estimations for organizational access, integration of care, interpersonal treatment and trust. This is given by the fact that the estimates for the upper bound of the 95% confidence interval for these PCMH domains are smaller than the estimates for the lower bound of the 95% confidence interval for communication (CI, 22.60%-44.87%).

Table 3: Relationship between PCMH Domains and Satisfaction with Overall Care

Adjusted (n=1292)	β	% Change [^]	p-value	[95% CI] %
Administrative Features of Care PCMH Domains				
Organizational Access	0.036	3.62	0.190	-1.75,9.28
Office Staff	0.160	17.31	0.000	10.64,24.38
Integration of Care	0.077	8.03	0.006	2.26,14.11
Physician-Patient Interaction PCMH Domains				
Communication	0.287	33.28	0.000	22.60,44.87
Interpersonal Treatment	0.072	7.51	0.041	0.31,15.22
Trust	0.080	8.31	0.009	2.03,14.97
Comprehensive Knowledge	0.185	20.36	0.000	11.53,29.89
Covariates				
Age	-0.001	-0.10	0.315	-0.30,0.09
Male (Ref: Female)	-0.012	-1.21	0.567	-5.22,2.98
Education (Ref: Some college or more)				
High school	0.000	0.05	0.983	-4.35,4.65
Less than high school	-0.006	-0.64	0.808	-5.63,4.62
Health Status (Ref: Excellent)				
Good	0.032	3.22	0.260	-2.31,9.06
Fair	0.010	0.99	0.734	-4.58,6.89
Poor	0.023	2.35	0.557	-5.28,10.58
Race (Ref: White Non-Hispanic)				
Black Non-Hispanic	0.036	3.67	0.133	-1.09,8.66
Other	0.019	1.89	0.563	-4.37,8.57
Marital Status (Ref: Married)				
Single	0.023	2.34	0.406	-3.10,8.09
Divorced	-0.007	-0.66	0.820	-6.17,5.17
Widowed	-0.016	-1.61	0.593	-7.28,4.41
Unknown	0.038	3.85	0.685	-13.50,24.68
Insurance Type (Ref: Private)				
Medicare	0.037	3.72	0.171	-1.56,9.28
Medicaid/Uninsured	-0.023	-2.25	0.443	-7.78,3.60
Unknown	-0.048	-4.72	0.376	-14.40,6.05
Clinic (Ref: Clinic A)				
Clinic B	0.039	3.94	0.176	-1.71,9.91
Clinic C	-0.012	-1.16	0.672	-6.37,4.33
Clinic D	0.023	2.31	0.498	-4.24,9.32

Model 2 - PCMH Domains and Satisfaction with Personal Doctor

Results for Model 2 are reported in Table 4. Five out of the seven PCMH domains had statistically significant associations with satisfaction with a personal doctor ($p < .05$). PCMH domains that did not have significant

results included integration with care and organizational access. All four physician-patient interaction PCMH domains were associated with satisfaction with a personal doctor at statistical significance ($p < .05$). Communication had the strongest association among this group of PCMH domains. Specifically, individuals providing a high score

Table 4: Relationship between PCMH Domains and Satisfaction with Personal Doctor

Adjusted (n=1292)	B	% Change ^A	p-value	[95% CI]
Physician-Patient Interaction PCMH Domains				
Communication	0.334	39.59	0.000	27.93,52.31
Interpersonal Treatment	0.111	11.68	0.003	3.88,20.07
Trust	0.133	14.20	0.000	7.29,21.54
Comprehensive Knowledge	0.209	23.22	0.000	13.79,33.43
Administrative Features of Care PCMH Domains				
Office Staff	0.142	15.28	0.000	8.43,22.54
Integration of Care	0.053	5.42	0.071	-0.44,11.63
Organizational Access	0.001	0.09	0.974	-5.32,5.81
Covariates				
Age	0.001	0.06	0.561	-0.14,0.27
Male (Ref: Female)	-0.032	-3.15	0.148	-7.26,1.14
Education (Ref: Some college or more)				
High school	-0.012	-1.14	0.631	-5.68,3.61
Less than high school	-0.007	-0.66	0.810	-5.87,4.84
Health Status (Ref: Excellent)				
Good	-0.008	-0.83	0.776	-6.37,5.04
Fair	-0.012	-1.17	0.697	-6.86,4.87
Poor	-0.045	-4.36	0.280	-11.79,3.69
Race (Ref: White Non-Hispanic)				
Black Non-Hispanic	0.014	1.39	0.582	-3.47,6.50
Other	0.002	0.15	0.964	-6.27,7.02
Marital Status (Ref: Married)				
Single	-0.029	-2.89	0.314	-8.28,2.81
Divorced	-0.041	-3.99	0.181	-9.55,1.91
Widowed	-0.082	-7.89	0.009	-13.43,-1.99
Unknown	-0.071	-6.84	0.467	-23.04,12.77
Insurance Type (Ref: Private)				
Medicare ^f	0.070	7.24	0.012	1.53,13.25
Medicaid/Uninsured	0.035	3.53	0.264	-2.58,10.02
Unknown	-0.029	-2.88	0.609	-13.16,8.62
Clinic (Ref: Clinic A)				
Clinic B	0.024	2.45	0.417	-3.36,8.61
Clinic C	-0.037	-3.60	0.204	-8.90,2.01
Clinic D	-0.007	-0.72	0.839	-7.35,6.40

for communication on average were 39.59% more satisfied with their personal doctor compared to those providing a low score ($p < .001$). Also this estimate was statistically larger than estimations for interpersonal treatment, trust, office staff, integration of care and organizational access given by the fact these latter domain's upper limit 95%

confidence interval was smaller than the lower limit 95% confidence interval for communication (CI, 27.59%-52.31%). Of the three PCMH domains categorized as administrative features of care, only office staff helpfulness was statistically significant ($p < .001$). Specifically, individuals reporting a high score for office staff

helpfulness were on average 15.28% more satisfied with their personal doctor compared to those providing a low score.

Discussion

Understanding whether certain domains are more or less important contributors to the patient experiences has important implications for primary practices in the process of becoming or operating as a PCMH. PCMHs require a significant investment of financial and human resources to be successful.^{17,18} Therefore knowledge of which PCMH dimensions and their associated domains have the most impact on outcomes is vital to successful medical home implementation. Medical homes can use this evidence to guide investment decisions in order to efficiently maximize patient satisfaction. Furthermore, given the focus of this study on type 2 diabetes, our results are especially salient to practices that expend a significant amount of time and money treating patients with this and other chronic conditions.

Our findings suggest a stronger association between PCMH domains and patient satisfaction than previously identified. Previous research revealed a small positive effect size,¹² however our results indicate a large effect size for significant domains. The stronger effect size in this study is likely due to our analytical design. By analyzing the relationship at the PCMH domain level we were able to identify effects that were not uncovered by previous investigations due to limitations associated with aggregating the PCMH domains into one score. For satisfaction with overall care, contrary to our expectations, physician-patient relationship domains had a stronger relationship overall compared to administrative features of care. However, we also found evidence that partially supported our hypotheses, as physician-patient relationship domains were more strongly associated with satisfaction with personal doctor compared to administrative features of care.

Our models indicate that communication and comprehensive knowledge were the most important domains regardless of the satisfaction measure. These domains could be most important for a number of reasons. First, both provide a foundation on which a physician-patient relationship can be built, both as evidence that the physician knows enough to do the job he or she has been entrusted to do, and by establishing an empathetic connection—that the physician understands something is wrong and needs to be addressed. Comprehensive knowledge, then, is reassuring to patients. Comprehensive knowledge may also indicate that patient's feel as though their physicians are hearing them—that their physicians listen to them and their concerns. Given the importance of communication and comprehensive knowledge for predicting patient satisfaction, physicians

would benefit from actions designed to not only enhance their understanding of patient situations, but also learning ways to better communicate that understanding. Physicians who cannot communicate to the patients their knowledge cannot convince the patient of that knowledge.

There are two main limitations to this study. First we used an observational cross-sectional design which does not allow us to infer causality. Second, we were unable to assess the full confounding effect of socio-economic status. We did not have access to two indicators of this construct: income and occupation. Previous literature has shown that these indices are important determinants of patient satisfaction especially through mechanisms pertaining to physician-patient interaction.²⁹ Therefore the effects of physician-patient interaction domains on patient satisfaction with personal doctor may be overstated. However, we were able to mitigate this effect by controlling for education.

Despite these limitations, this study makes a significant contribution to research investigating the impact of PCMH domains in primary health care. Specifically it is the first study we are aware of that has identified the relative importance of different dimensions of PCMH domains on various measures of patient satisfaction for type 2 diabetes. However, more detailed evidence is needed. Therefore, future research should build upon our findings by conducting this type of analysis in populations beyond patients with diabetes. Moreover, future analyses can improve our understanding of PCMH's impact on patient satisfaction by including assessments of care delivered by nurse practitioners. Continuing to build evidence at this level will guide primary care practices as they transform into effective PCMHs.

Conclusion

Our findings provide clear indications for practices aiming at improving patient satisfaction with care. As practices continue to transform, a focus on improving patient interactions with providers (especially communication and provider understanding of the patient's medical condition) will likely contribute the most to patient satisfaction and ensuring a patient-centered approach to health care delivery.³⁰ Communication between a physician and a patient can be enhanced in a number of ways including changing clinician behavior.³¹ While our findings suggest that efforts aimed at medical home redesign should emphasize PCMH domains that characterize interpersonal elements of care, the importance of some of the administrative features cannot be underestimated. For example, elements that constitute organizational access (e.g. getting care and appointments when it is needed) are important for more timely care and improved communication. For instance, a doctor cannot communicate with their patient without some form of

access facilitated by the organization. Similarly, care integration will enable improvements in comprehensive knowledge of the patient's condition. Future research and analysis will confirm the extent to which administrative features of care moderate the impact of physician-patient interaction domains on patient satisfaction. Furthermore, it will enable already established PCMHs to improve their delivery of care to patients struggling with chronic illnesses such as Type II Diabetes.

References

1. Grumbach K, Bodenheimer T. A primary care home for Americans: putting the house in order. *JAMA*. Aug 21 2002;288(7):889-893.
2. Bodenheimer T. Coordinating care--a perilous journey through the health care system. *N Engl J Med*. Mar 6 2008;358(10):1064-1071.
3. Bodenheimer T, Wagner EH, Grumbach K. Improving primary care for patients with chronic illness. *Jama-J Am Med Assoc*. Oct 9 2002;288(14):1775-1779.
4. Grumbach K, Bodenheimer T. A primary care home for Americans: putting the house in order. *Jama*. Aug 21 2002;288(7):889-893.
5. *AHA Research Synthesis Report: Patient-Centered Medical Home (PCMH)*. Chicago: American Hospital Association;2010.
6. Ferrante JM, Balasubramanian BA, Hudson SV, Crabtree BF. Principles of the patient-centered medical home and preventive services delivery. *Ann Fam Med*. Mar-Apr 2010;8(2):108-116.
7. Williams JW, Jackson GL, Powers BJ, et al. The Patient-Centered Medical Home. Closing the Quality Gap: Revisiting the State of the Science. Evidence Report No. 208. Rockville, MD.: AHRQ; 2012.
8. Vest JR, Bolin JN, Miller TR, Gamm LD, Siegrist TE, Martinez LE. Medical homes: "where you stand on definitions depends on where you sit". *Med Care Res Rev*. Aug 2010;67(4):393-411.
9. Bojadzievski T, Gabbay RA. Patient-centered medical home and diabetes. *Diabetes Care*. Apr 2011;34(4):1047-1053.
10. Moran K, Burson R, Critchett J, Olla P. Exploring the cost and clinical outcomes of integrating the registered nurse-certified diabetes educator into the patient-centered medical home. *Diabetes Educ*. Nov-Dec 2011;37(6):780-793.
11. Doyle C, Lennox L, Bell D. A systematic review of evidence on the links between patient experience and clinical safety and effectiveness. *BMJ Open*. January 1, 2013 2013;3(1).
12. Jackson GL, Powers BJ, Chatterjee R, et al. Patient-Centered Medical Home A Systematic Review. *Ann Intern Med*. Feb 5 2013;158(3):169-+.
13. Peikes D, Zutshi A, Genevro JL, Parchman ML, Meyers DS. *Early Evidence on the Patient-Centered Medical Home*. Rockville, MD.: AHRQ; Feb 2012. 12-0020-EF.
14. Kern LM, Dhopeswarkar RV, Edwards A, Kaushal R. Patient Experience Over Time in Patient-Centered Medical Homes. *Am J Manag Care*. May 2013;19(5):403-410.
15. Heyworth L, Bitton A, Lipsitz SR, et al. Patient-centered medical home transformation with payment reform: patient experience outcomes. *Am J Manag Care*. Jan 2014;20(1):782-785.
16. Crabtree BF, Chase SM, Wise CG, et al. Evaluation of patient centered medical home practice transformation initiatives. *Med Care*. Jan 2011;49(1):10-16.
17. Jaen CR, Ferrer RL, Miller WL, et al. Patient outcomes at 26 months in the patient-centered medical home National Demonstration Project. *Ann Fam Med*. 2010;8 Suppl 1:S57-67; S92.
18. Nutting PA, Crabtree BF, Miller WL, Stange KC, Stewart E, Jaen C. Transforming physician practices to patient-centered medical homes: lessons from the national demonstration project. *Health Aff (Millwood)*. Mar 2011;30(3):439-445.
19. Safran DG, Karp M, Coltin K, et al. Measuring patients' experiences with individual primary care physicians. Results of a statewide demonstration project. *J Gen Intern Med*. Jan 2006;21(1):13-21.
20. NCQA. Start to Finish: Patient Centered Medical Home (PCMH) Recognition. 2013; <http://www.ncqa.org/Portals/0/PCMH%20brochure-web.pdf>, 2013.
21. Hall AG, Webb FJ, Tamayo-Friedel C. What's Inside a Medical Home? Providers and Staff Give Insight. *Journal of Ambulatory Care Management*. June 2014 2014;37(2):106-119.
22. CMS. ICD-9 Look Up. <http://www.cms.gov/medicare-coverage-database/staticpages/icd-9-code-lookup.aspx>, 2013.
23. Safran DG, Kosinski M, Tarlov AR, et al. The Primary Care Assessment Survey: tests of data quality and measurement performance. *Med Care*. May 1998;36(5):728-739.
24. AHRQ. CAHPS Surveys and Tools to Advance Patient-Centered Care. 2012; <https://cahps.ahrq.gov/>, 2013.
25. Andersen RM. Revisiting the behavioral model and access to medical care: does it matter? *J Health Soc Behav*. Mar 1995;36(1):1-10.
26. Andersen RM. Revisiting the behavioral model and access to medical care: does it matter? *J Health Soc Behav*. Mar 1995;36(1):7.
27. SAS Version 9.3. Cary, NC: The SAS Institute; 2012.
28. Stata Version 13.1. College Station, Texas: StataCorp, LP; 2013.
29. Willems S, De Maesschalck S, Deveugele M, Derese A, De Maeseneer J. Socio-economic status of the patient and doctor-patient communication: does it

make a difference? *Patient Educ Couns.* 2005;56(2):139-146.

30. Finney Rutten LJ, Agunwamba AA, Beckjord E, Hesse BW, Moser RP, Arora NK. The Relation Between Having a Usual Source of Care and Ratings of Care Quality: Does Patient-Centered Communication Play a Role? *J Health Commun.* May 26 2015:1-7.
31. Ong LM, de Haes JC, Hoos AM, Lammes FB. Doctor-patient communication: a review of the literature. *Soc Sci Med.* Apr 1995;40(7):903-918.